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This enormous project is for the most part presented as a success in the making, although not everyone would agree with this evaluation.

All of the chapters in *Pushing the Limits* originally appeared over a span of ten years as articles in *The American Scientist*. Because they were published separately, each of them can be taken as a stand-alone piece, allowing readers to dip into individual chapters in accordance with their own interests. At the same time, however, this episodic quality results in the book's greatest shortcoming—the absence of a framework to hold everything together. Given the author's deep understanding of engineering practices and the forces that drive them, this would have been an excellent opportunity to reflect on the economic, aesthetic, technical, and personal motivations that cause the limits to be pushed.

As the chapters on failed engineering projects indicate, sometimes the limits push back with a vengeance, but the reasons for this happening remain for the most part unexplored. One of Petroski's other books, *To Engineer Is Human*, carries the subtitle *The Role of Failure in Successful Design*, so this is an issue that he has confronted before. A chapter specially written for this new book would have been an appropriate place for a further consideration of the underlying causes of success and failure. Instead, the last two chapters consist of previously published articles that celebrate more engineering accomplishments of the past.

Pushing the Limits also can be criticized for some minor sins of omission and commission. In regard to the first, many of the narratives would have benefited from illustrations and diagrams like the one used to illustrate the structural principles employed in the design of the Dorton Arena in North Carolina. For the latter, the final chapter can be taken to task for its perpetuation of the canard that the U.S. Commissioner of Patents claimed at the end of the nineteenth century that there was nothing significant left to invent. These are minor flaws in a work that will be enjoyed by historians of technology and members of the general public alike.

RUDI VOLTI

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Hunters, Herders, and Hamburgers: The Past and Future of Human–Animal Relationships.

By Richard W. Bulliett. New York: Columbia University Press, 2005. Pp. 264. $27.50.

"Let's start with sex and blood." With that striking first sentence, Richard Bulliett sets out to explain what he sees as a dramatic increase in fantasies of pornography and violence—and a lot of other social phenomena—in the late twentieth century.

Bulliett's key argument rests on the distinction between two conditions: domesticity and postdomesticity. In domesticity, most members of a society have daily contact with domestic animals other than pets. Americans lived in this agrarian state in the past, and most of the developing world lives in it today. Members of domestic societies take killing and copulation of animals for granted because they encounter both in their daily lives. In postdomesticity, people continue to depend on domestic animals for food, fiber, and hides, but most members of society live far away from them both physically and emotionally. This separation leads people to feel guilty about raising animals for slaughter, to shield children from the realities of animal death, to humanize animals (especially pets), to embrace vegetarianism, to oppose hunting and blood sports, and to explore sexual fantasies.

To set up this argument, Bulliett introduces two prior human conditions: separation and predomesticity (the latter joins domesticity and postdomesticity as neologisms). Separation marked the moment when humans stopped thinking of themselves as part of nature and started thinking of themselves as something different, special, and often superior. Bulliett locates separation somewhere between two million and 40,000 years ago, and he mulls several hypotheses provided over the ages to identify its causes. This conjectural history is geared less to settling on a hypothesis and more toward emphasizing that the explanations people proffer grow out of their own relation to domestication. Predomesticity is Bulliett's substitute term for hunting and gathering. He emphasizes that predomestic peoples revered wild animals.

Most of the book focuses on domesticity and postdomesticity. The key mental task of domestication was dividing animals into two groups, the domestic and the wild. Domestic animals lost their spiritual qualities and became instruments for meeting human desires; wild animals found themselves redefined in relation to domestic animals—not as gods, but as predators, prey, competitors, vermin, or spectacle. Postdomesticity is still evolving, but we see its signs all around us in children's books with animal heroes, vegetarian restaurants, zoos, the animal-rights movement, and Hollywood blockbusters that tease us with sex and shock us with blood.

Like Jared Diamond in *Guns, Germs, and Steel*, Bulliett reminds us that the mundane world of raising animals continues to have a profound impact on the world today. In the history of technology, this book joins the small but growing literature on the relationship between organisms and technology. One of the seminal works in this regard was Bulliett's own *The Camel and the Wheel*, and recent work has brought this discussion into the industrial era (Susan Schrepfer and Philip Scranton, eds., *Industrializing Organisms*). Graduate students looking around for thesis topics might do well to consider this rich, and largely untapped, vein of history.

Bulliett's strength is in emphasizing the cultural consequences of material changes. People who rely on animals for their livelihood regard their

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charges in different ways than people who do not. There is no question that urbanites are more squeamish about animal slaughter than farmers and ranchers. Moral vegetarianism is more common in cities than the countryside. It is hard to imagine the animal-rights movement arising in rural Kansas. The Romantic project, which originated in urban society, continues to evolve today. There is much to recommend Bulliett's argument.

At the same time, I'm not sure that everything Bulliett attributes to postdomesticity arises from it. His starting phenomenon—the prominent role of sex and blood in modern cinema—can be as much at home in the domestic as in the postdomestic world. When I lived in the rural Philippines, men who slaughtered goats, pigs, and dogs seemed to enjoy cinematic violence and sexual fantasies every bit as much as urban Americans. Nor are all the lines of causation convincing. Bulliett suggests that people applied the word "domestication" to animals for the first time in the mid- to late nineteenth century because this development "depended on the Darwinian notion that one species could evolve into another" (p. 46). But that idea was common among naturalists before Charles Darwin published *The Origin of Species* in 1859. Thomas Pennant's *History of Quadrupeds*, to cite one example, suggested in 1781 that the North American dog "derived from the wolf, tamed and domesticated" while the Old World dog descended from the jackal (p. 221).

This book is a welcome addition to the literature. It stakes out a big, bold argument that strives to explain a range of phenomena in an elegant way. The thesis is stimulating and the examples often arresting. We need more such works.

EDMUND RUSSELL

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Fathoming the Ocean: The Discovery and Exploration of the Deep Sea.

By Helen M. Rozwadowski. Cambridge, Mass.: Harvard University Press, 2005. Pp. xii+276. $25.95.

The early development of oceanography as a field, argues Helen Rozwadowski, cannot be understood in isolation from the ways in which Western societies imagined and used the waters of the world. Scientific acts of measuring the ocean's depths and learning about its physical characteristics and resources were part and parcel of broader attempts at "fathoming the ocean." These efforts entailed a "cultural redefinition" of the sea, a "shift away from understanding and experiencing the ocean as an expansive divide, a watery highway, or an unfathomable barrier between places," to an understanding of the sea as "a destination and a location" (p. 214).